

## **SECTION 33 83 05**

### **RADIO NETWORK / REGIONAL HIGH LEVEL RADIO SYSTEM**

#### **PART 1 – GENERAL**

##### **1.01 SECTION INCLUDES**

This Section covers the general approach for additions or modifications to the Regional High Level Radio System.

##### **1.02 RELATED SECTIONS:**

- A. 33 83 04, Trunked Radio Network / Distributed Amplifier Radiating Cable System
- B. 33 83 06, Trunked Radio Network / Bi-directional Radio Amplifier System

##### **1.03 MEASUREMENT AND PAYMENT**

All work required under this Section will be measured separately and will be paid for as part of the Contract lump-sum price, as part of the related item of work, as indicated on the Bid Schedule of the Bid Form.

##### **1.04 REFERENCES**

- A. Federal Communications Commission (FCC) Rules  
Code of Federal Regulations, 47 CFR
- B. National Public Safety Planning Advisory Committee (NPSPAC)  
Region 6 (Northern California) planning regulations for 800 MHz Public Safety Agencies
- C. Telecommunications Industry Association (TIA)  
Technical Systems Bulletin TSB 88-A
- D. M/A-Com Incorporated  
Document AE/LZT 123 4618/1, Site Grounding and Lightning Protection

##### **1.05 SUBMITTALS**

- A. General: Refer to Section 01 33 00, Submittal Procedures, and Section 01 33 23, Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit Shop Drawings showing the layout of the system identifying the location of equipment and accessories.

- C. Product Data: Submit manufacturers' Product Data for all manufactured items of materials, equipment, and accessories shown on the Shop Drawings.
- D. Test Reports: Submit Test Reports of all tests conducted by the Contractor.
- E. Certificates: Submit Certificates certifying that the equipment tested is ready for use.

## **1.06 DESCRIPTION**

The District owns and operates an 800 mhz radio network. Modifications to the radio network are anticipated over time due to expansion of the BART system. The Regional High Level (RHL) Radio System is one element of the BART radio network. The RHL system is used for voice communications between Operations Control Center and trains when an area of the BART trunked system is out of service, or when BART Police officers or maintenance workers roam beyond the coverage area of the BART trunked system. It is a secondary and backup radio communication medium throughout the District, generally extending to the borders of those counties having BART facilities.

## **PART 2 – PRODUCTS**

### **2.01 DESIGN**

#### **A. General**

1. The Designer shall design and furnish modifications and additions to the RHL Radio System to satisfy design performance requirements. The existing RHL design shall be followed as guideposts for equipment selection, design, and their interconnections.
2. RHL Radio System coverage shall be made available above and below ground along the BART operating alignment, wayside facilities, and inside specific buildings as required. Coverage shall also extend to major freeways 15 miles from the edges of nearest BART facilities. Generally, coverage should be as extensive as possible. Coverage shall specifically include the out-of-doors areas of BART operating alignment and wayside facilities including the stations, yards and shops, operations control center, maintenance facilities, police zone facilities, administrative offices, and revenue processing facilities.
3. Though primarily an above ground system, the Designer shall include the equipment and designs necessary to furnish the RHL radio signals into the BART underground and specified buildings.
4. RHL Radio System design and equipment shall adhere to applicable codes and regulations, including Federal Communications Commission (FCC) Rules, and National Public Safety Planning Administration Committee (NPSPAC) Region 6 (Northern California) planning regulations for 800 MHz Public Safety Agencies. All transmitting equipment shall be FCC type certified.

**B. Design Modifications and Additions Requirements:**

Modifications or additions to the Regional High Level Radio System shall satisfy the following general design guidance:

1. Modifications or extension to the RHL Radio System design shall be fully compatible with and become an integral part of the existing radio network.
2. Unless otherwise noted, the RHL Radio System shall be designed to operate as a conventional, analog, GPS-coordinated simulcast system. It shall operate in the 800 Mhz radio band, and upon the one duplex 800 Mhz NPSPAC radio channel assigned to the District. CTCSS tones shall be provided for un-squelching the radio.
3. RHL Radio System modifications or additions shall be compatible with and provide the same functions and operability as the existing RHL radio system. This includes a remote network management capability, and interfaces to other elements of the BART Radio Network. If upgrades to any aspect of the existing BART Radio Network are required to establish compatibility or functionality to the new equipment, then those upgrades shall become part of the work.
4. If underground RHL radio coverage is necessary, low powered 800 mhz analog transmitters are to be added as described herein.

**2.02 SYSTEM REQUIREMENTS**

Modifications or additions to the RHL Radio System shall specifically satisfy the following requirements:

**A. Performance Requirements:**

1. The RHL radio system shall provide radio coverage outdoors and around all areas along the BART track alignment and on the surface above tunnels and subways. With enhancement, the coverage shall extend inside BART wayside facilities including passenger stations, parking garages, train control and communications room, traction power substations, maintenance, yard and shops, revenue processing buildings, administration buildings, and other BART facilities supporting train operations, maintenance, administration, engineering, and police activities. Above ground coverage shall extend 15 miles in all directions of the alignment at the prescribed performance levels.
2. The system reliability performance goals of the RHL system shall be with 90% coverage at 90% of the time. The system shall be balanced between talk out and talk in directions. All coverage shall deliver performance deemed "clear with occasional background noise", and as defined in TIA Standard TSB 88-A Delivered Audio Quality (DAQ) 3.4. Performance standards shall be based upon use of vehicle mounted mobile radios.
3. Unless otherwise specified, RHL coverage in underground trackway, stations, and facilities shall be made by a connection to the Distributed Amplifier System (DAS)--an underground amplifier system which is part of the BART radio

network, and specified in Sections 33 83 04, Radio Network / Distributed Amplifier Radiating Cable System and 33 83 06, Radio Network / Bi-directional Radio Amplifier System. Performance and reliability goals of the RHL coverage deployed underground shall be governed by the DAS system.

- a. A low power, 800 mhz, analog radio transmitter/receiver shall be deployed to couple above ground RHL RF radio signals into the DAS underground. The low power transmitter shall be co-located with the primary trunked radio site feeding the BART underground areas and covered by the overlying RHL (mountain top) simulcast radio site. A second low power 800mhz transmitter shall be deployed at a secondary trunked radio site of redundancy of radio coverage underground.
  - b. Audio signals to the co-located trunked site low power RHL transmitter shall originate from the LMA Central Control equipment. Transmit audio shall come from the audio distribution buss equipment. Receive audio shall be applied to the RHL voter network. Modifications to this LMA equipment and transport of these signals to the co-located trunked site RHL transmitter shall be part of the design.
  - c. Necessary interface port connections for the RHL connection to the DAS shall be provided by the DAS system. However, the proper RF signal levels applied to DAS are the responsibility of the RHL designer.
4. Unless otherwise specified, RHL coverage signal strength outside of surface BART facilities shall be sufficiently strong that a bidirectional amplifier can be deployed to extend the above ground RHL radio signals into the facility. The requirements for the bidirectional amplifier equipment are specified in Section 33 83 06, Trunked Radio Network / Bi-directional Radio Amplifier System.
  5. RHL Radio System equipment shall be designed to operate in an environmentally controlled facility.
  6. RHL Radio System equipment shall be housed in seismic zone 4 rated equipment cabinets, unless otherwise designated.
  7. New RHL Radio System site equipment shall be designed anticipating that backup site power is by an automatic start generator-standby source, connected to an automatic transfer switch. The equipment shall be capable of riding thru the loss of power for a minimum of 15 seconds without loss of operation, unless otherwise designated.
  8. All antenna entrances to the RHL radio equipment facility shall be protected against lightning strikes.

#### B. System Interface Requirements

1. Audio, data, and control signals to and from each newly proposed transmit site shall interface with the existing Enhanced Digital Access Communications System (EDACS™) control point radio equipment at Lake Merritt and shall also be configured to be compatible with the requirements of the BARTnet.

2. Below ground radio coverage shall be provided to all subway stations and tunnel areas, and shall be designed to interface with the radio network equipment in a manner similar to that of the existing below ground radio communication equipment throughout the District. Typically, fiber optic cables are used to transfer the RF signal between tunnel portal section equipment and specific above ground radio site equipment. An interface to the underground Distributed Amplifier Radiating Cable System (DAS) equipment at the trunk radio site shall be anticipated in system design.
3. The District shall be responsible for licensing of RHL system. The Designer shall provide the District with requested technical information, including any predictive coverage and performance maps, descriptions, and reports.
4. The Designer shall furnish other support that may be necessary to obtain licensing approval from all agencies in the licensing process.

C. Radio System Site Locations:

1. If new radio sites are required, such radio sites shall be located to obtain the specified system radio coverage and reliability percentages.
2. RHL radio site locations shall be evaluated to be placed on developed radio sites, typically on a mountain top, adjacent to the area where coverage is required.
3. If a suitable location cannot be found among developed radio sites, other off-site property locations may be evaluated. Suitability of the site shall be determined by RF coverage predications, commercial availability of the site, and site access cost; and ranked in order of design preference.
4. An RF Coverage assessment to evaluate proposed extension to existing RHL Radio System coverage shall be conducted as part of the design planning.
  - a. Assessment shall consist of two parts:
    - 1) The first part is a computer generated mapping showing predicted radio performance from each proposed radio site, as well as a composite model of all sites.
    - 2) The second part is a drive test to verify real world performance of the computer modeling predictions of the selected site location. Signal strength, urban clutter, simulcast time domain interference over the BART right of way are minimally required in the computer prediction.
  - b. Existing system coverage modifications, if required, shall be developed and shown in the predictive mapping of extension sites.
  - c. A performance guarantee from the manufacturer/designer shall accompany the RF Coverage assessment.
5. New RHL transmitter site equipment shall be designed and provisioned to limit or minimize performance degradation to the radio system from foreign sources.

D. Dispatcher Console Equipment

Control over the RHL radio system shall be accomplished by the C3 Maestro Console system, as manufactured by M/A-Com Inc. The system shall interface to the existing EDACS™ control point radio equipment at Lake Merritt. All necessary interface to the control point equipment shall be provided as a part of the RHL system

**PART 3 – EXECUTION**

NOT USED

**END OF SECTION 33 83 05**